

CLAIMS

We claim:

- 1 1. A sealing apparatus, comprising:
2 a housing having a bore formed therethrough;
3 a cylindrical member extending through said bore in said housing;
4 an external annular sealing lip formed on said cylindrical member, said lip
5 being adapted to contact said housing and flex in a sealing relationship
6 when said cylindrical member is urged toward said housing; and
7 an external annular shoulder formed on said cylindrical member between said
8 sealing lip and said housing, said shoulder being adapted to abut said
9 housing only after said flexing of said sealing lip and arrest axial
10 movement of said cylindrical member relative to said housing.
- 1 2. The apparatus recited in claim 1, further comprising:
2 a frusto-conical surface on said housing; and
3 an annular edge formed on said sealing lip, said sealing lip annular edge being
4 positioned to contact said frusto-conical surface of said housing in said
5 sealing relationship, prior to said abutment of said shoulder against
6 said housing.
- 1 3. The apparatus recited in claim 1, further comprising:
2 a frusto-conical surface on said housing; and
3 a frusto-conical surface formed on said annular shoulder, said frusto-conical
4 surface of said shoulder being positioned to abut said frusto-conical
5 surface of said housing, after said sealing lip contacts said housing.

1 4. The apparatus recited in claim 1, further comprising:
2 first and second frusto-conical surfaces on said housing;
3 an annular edge formed on said sealing lip, said sealing lip annular edge being
4 positioned to contact said first frusto-conical surface of said housing in
5 said sealing relationship; and
6 a third frusto-conical surface formed on said annular shoulder, said frusto-
7 conical surface of said shoulder being positioned to abut said second
8 frusto-conical surface of said housing, after said sealing lip contacts
9 said first frusto-conical surface of said housing.

1 5. The apparatus recited in claim 1, wherein said lip is adapted to contact
2 said housing as said cylindrical member advances through said bore.

1 6. An apparatus for sealing against valve stem leakage, comprising:
2 a valve bonnet having a stem bore formed therethrough;
3 a valve stem extending through said stem bore of said valve bonnet;
4 an annular backseat formed on an inside surface of said bonnet, surrounding
5 said stem bore;
6 an external annular sealing lip formed on said stem, within said valve bonnet,
7 said lip being adapted to flex and seal against said backseat when said
8 stem is urged toward said bonnet; and
9 an external annular shoulder formed on said stem between said sealing lip and
10 said backseat, said shoulder being adapted to abut said backseat only
11 after said flexing of said sealing lip and arrest axial movement of said
12 stem.

1 7. The apparatus recited in claim 6, further comprising:
2 a frusto-conical internal surface on said annular backseat; and
3 an annular edge formed on said sealing lip, said sealing lip annular edge being
4 positioned to contact said frusto-conical internal surface of said
5 backseat in a sealing relationship, prior to said abutment of said
6 shoulder against said backseat.

1 8. The apparatus recited in claim 6, further comprising:
2 a frusto-conical internal surface on said annular backseat; and
3 a frusto-conical external surface on said annular shoulder, said frusto-conical
4 surface of said shoulder being positioned to abut said frusto-conical
5 internal surface of said backseat, after said sealing lip contacts said
6 backseat.

1 9. The apparatus recited in claim 6, further comprising:
2 first and second frusto-conical surfaces on said annular backseat;
3 an annular edge formed on said sealing lip, said sealing lip annular edge being
4 adapted to contact said first frusto-conical backseat surface; and
5 a third frusto-conical surface on said annular shoulder, said frusto-conical
6 surface of said shoulder being positioned to abut said second frusto-
7 conical backseat surface, after said sealing lip contacts said first frusto-
8 conical backseat surface.

1 10. The apparatus recited in claim 6, wherein said lip is adapted to contact
2 said backseat as said stem advances outwardly through said stem bore.

1 11. An apparatus for sealing against valve stem leakage, comprising:
2 a valve bonnet having a stem bore formed therethrough;
3 a valve stem extending through said stem bore of said valve bonnet;
4 an annular backseat formed on an inside surface of said bonnet, surrounding
5 said stem bore, said backseat comprising at least one frusto-conical
6 surface;
7 an external annular sealing lip formed on said stem, an annular edge of said lip
8 being adapted to contact said at least one frusto-conical backseat
9 surface in a sealing relationship, said lip being adapted to flex when
10 said stem is urged toward said bonnet; and
11 an external annular shoulder formed on said stem between said sealing lip and
12 said backseat, said shoulder being adapted to abut said backseat only
13 after said flexing of said sealing lip and arrest axial movement of said
14 stem.

1 12. The apparatus recited in claim 11, further comprising a frusto-conical
2 external surface on said annular shoulder positioned to abut said at least one frusto-
3 conical backseat surface, after said sealing lip contacts said backseat in said sealing
4 relationship.

1 13. The apparatus recited in claim 12, wherein:
2 said annular backseat comprises first and second said frusto-conical surfaces;
3 said annular edge of said lip is adapted to contact said first frusto-conical
4 backseat surface; and
5 said frusto-conical external surface of said annular shoulder is positioned to
6 abut said second frusto-conical backseat surface, after said sealing lip
7 contacts said first frusto-conical backseat surface.

1 14. The apparatus recited in claim 11, wherein said lip is adapted to
2 contact said backseat as said stem advances outwardly through said stem bore.

1 15. A method of sealing between a cylindrical member and a housing,
2 comprising:
3 providing a cylindrical member extending through a bore in a housing;
4 providing an external annular sealing lip and an external annular shoulder on
5 said cylindrical member, said shoulder being positioned between said
6 sealing lip and said housing;
7 urging said cylindrical member toward said housing to flex said lip and seal
8 said lip against said housing; and
9 then, abutting said shoulder against said housing, thereby arresting axial
10 movement of said cylindrical member relative to said housing.

1 16. The method recited in claim 15, further comprising:
2 providing a concave frusto-conical surface on said housing and an annular
3 edge on said sealing lip; and
4 sealing said sealing lip annular edge against said concave frusto-conical
5 surface of said housing, before said abutting of said shoulder against
6 said housing.

1 17. The method recited in claim 15, further comprising:
2 providing a concave frusto-conical surface on said housing and a convex
3 frusto-conical surface on said annular shoulder; and
4 abutting said convex frusto-conical surface of said shoulder against said
5 concave frusto-conical surface of said housing, after said sealing of
6 said lip against said housing.

1 18. The method recited in claim 15, further comprising:
2 providing first and second concave frusto-conical surfaces on said housing, an
3 annular edge on said sealing lip, and a convex frusto-conical surface
4 on said annular shoulder;
5 sealing said sealing lip annular edge against said first concave frusto-conical
6 surface of said housing; and
7 then, abutting said convex frusto-conical surface of said shoulder against said
8 second concave frusto-conical surface of said housing.

1 19. The method recited in claim 15, further comprising advancing said
2 cylindrical member through said bore to cause said sealing lip to contact said housing.